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ELECTROSTRICTION MEASUREMENTS IN GADOLINIUM DOPED CERIUM OXIDE

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Off-center shift of the Ce^{4+} ions in the cubic oxygen environment away from oxygen vacancies under the action of the external electric field in $Ce_{0.9}Gd_{0.1}O_{2-x}$ (CGO) results in appearance of the "giant" electromechanical strain [1]. This strain looked pretty attractive for the application and initially was attributed to the electrostriction phenomena [1]. However up to date the phenomena has been studied only by bulk technique based on the cantilever resonator approach [2]. On contrary microscopical studies in CGO (the most part which was realized on 1st harmonic) attributed induced strain to the Vegard expansion due to electrodiffusion of the oxygen vacancies or polarons [3,4].

Here we performed comprehensive analysis both by multi-harmonic close-to-resonance strain based scanning probe microscopy and laser interferometry to probe electrostriction in the CGO thin films and bulk ceramics.

Interferometric measurements have been realized in a special manner allowing to avoid the effect of the sample bending that could lead to the overestimation of the piezoelectric and electrostriction coefficients. The resulting electrostriction coefficient was about 10^{-19} $m^2 \cdot V^{-2}$ at 13 kHz.

Strain based scanning probe microscopy (S-SPM) was realized both at the first and at the second harmonic. Though resulted S-SPM images are correlated with topography the value of registered electrostriction: $6.7 \cdot 10^{-19}$ $m^2 \cdot V^{-2}$ is quite close to those measured by interferometry technique. Voltage and time spectroscopy were performed to clarify the nature of the registered signal. Additional modelling in COMSOL Multiphysics was performed to feed a parallel between bulk and local measurements.

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IMPACT OF 3D-METAL OXIDES ON THE STRUCTURE AND PROPERTIES OF Fe(Se,Te)-TYPE SUPERCONDUCTORS

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Discovery of superconductivity in FeSe, known as "11 system", has substantially activated the studies in the field of superconductivity in transition metal chalcogenides [1, 2]. It was found that the critical transition temperature T_c of FeSe be strongly affected by doping or by substitution in both the Fe and chalcogen sublattices, as well as by application of hydrostatic pressure and strains. The aim of the present work is to study the effect of the transition metal oxides TiO_2 and Fe_2O_3 on the properties of the $Fe_{1.02}Se_{0.5}Te_{0.5}$ and $Fe_{1.02}Se$ superconducting materials suggesting that both the iron and chalcogen sublattices may be influenced by introducing these oxides. Polycrystalline samples with nominal compositions $Fe_{0.92}Y_{0.1}Se$ and $Fe_{0.92}Y_{0.1}Se_{0.5}Te_{0.5}$ where (Y = TiO_2 or Fe_2O_3) were prepared by a solid state reaction method. The synthesized samples have been studied by means of X-ray diffraction and electrical resistivity measurements. According to X-ray diffraction the synthesized samples $Fe_{0.92}Y_{0.1}Se$ and $Fe_{0.92}Y_{0.1}Se_{0.5}Te_{0.5}$ contain two phases: the tetragonal phase with the PbO-type structure (space group *P4/nmm*) and hexagonal phase of the NiAs-type structure (space group $P6_3/mmc$). After synthesis and heat treatment, the presence of oxides was not detected in all the $Fe_{0.92}Y_{0.1}Se$ samples, while only small amount of Fe_3O_4 was found to exist in $Fe_{0.92}(Fe_2O_3)_{0.1}Se0.5Te0.5$ and $Fe_{0.92}(TiO_2)_{0.11}Se_{0.5}Te_{0.5}$.